

In the Claims:

Please cancel Claims 14, 17, and 40 without prejudice, amend Claims 1-13, 16, 18-39 and 41-43 as shown below, and add new Claims 24-28 prior to calculating the fees due for this patent application. A complete copy of the claims including marked-up versions of each claim which is amended in this Preliminary Amendment appears below.

- 1 1. (Currently Amended) A solid state laser gain medium having first and second ends along a laser optical axis in which at least one end is profiled to provide a level of thermal lensing at a predetermined operating power, in which the predetermined beam quality is ~~centred~~ centered substantially on a maximum at the predetermined operating pump power.
- 1 2. (Currently Amended) A solid state laser gain medium as ~~claimed in claim 1~~ defined in Claim 1, in which both ends of the solid state laser gain medium are profiled.
- 1 3. (Currently Amended) A solid state laser gain medium as ~~claimed in any preceding claim defined in Claim 1~~, in which the solid state laser gain medium is formed of Nd:YAG.
- 1 4. (Currently Amended) A laser oscillator cavity including a solid state laser gain medium as ~~claimed in any preceding claim~~ defined in Claim 1.

1    5. (Currently Amended) A laser oscillator cavity as ~~claimed in claim 4 defined in~~  
2    Claim 4, further comprising comprising:  
3       flat cavity end reflectors.

1    6. (Currently Amended) A laser oscillator cavity as ~~claimed in any of claims 3 to 5~~  
2    defined in Claim 4, further comprising comprising:  
3       a Q-switch having first and second acousto-optic cells and respective first and  
4       second non-parallel ~~polarisation~~ polarization orientations.

1    7. (Currently Amended) A laser oscillator cavity as ~~claimed in any of claims 4 to 6~~  
2    defined in Claim 4, further including a Q-switch comprising comprising:  
3       at least one acousto-optic cell having a reflective end forming a cavity end  
4       reflector.

1    8. (Currently Amended) A laser oscillator cavity as ~~claimed in any of claims 3 to 7~~  
2    defined in Claim 4, further comprising  
3       a frequency converter; and  
4       a frequency selective reflector between the solid state laser gain medium and the  
5       frequency converter.

1 9. (Currently Amended) A laser including a solid state laser gain medium as claimed  
2 ~~in any of claims 1 to 2 or a cavity as claimed in any of claims 3 to 8. defined in Claim 1.~~

1 10. (Currently Amended) A laser as ~~claimed in claim 9~~ defined in Claim 9, further  
2 comprising comprising:  
3 a side-pumping diode element.

1 11. (Currently Amended) A Q-switch for a laser comprising comprising:  
2 first and second acousto-optic cells in respective first and second non-parallel  
3 polarisation polarization orientations.

1 12. (Currently Amended) A Q-switch as ~~claimed in claim 11~~ defined in Claim 11,  
2 further comprising comprising:  
3 a reflective surface arranged to form a laser cavity mirror.

1 13. (Currently Amended) A laser including a Q-switch as ~~claimed in claim 11 or claim~~  
2 ~~12. defined in Claim 11.~~

14. (Cancelled).

1 15. (Original) An optical gain cavity including a gain medium and arranged to operate  
2 at a substantially maximum beam quality for a predetermined operating power.

1    16. (Currently Amended) A laser cavity ~~comprising~~ comprising:

2                ~~as a laser cavity element, element;~~

3                a first end ~~reflector, reflector;~~

4                an output end ~~reflector reflector;~~ and

5                a gain medium provided ~~there between, between the first end reflector and the~~

6                ~~output end reflector,~~ the cavity further ~~comprising~~ comprising:

7                        ~~as a laser cavity element frequency converter between the gain medium and~~

8                        the output end ~~reflector reflector;~~ and

9                        a frequency selective reflector between the gain medium and the frequency

10                  converter in which the laser cavity elements are aligned on a common physical

11                  axis.

17. (Cancelled).

1    18. (Currently Amended) A laser cavity ~~a claimed in claim 16 or 17 as defined in~~

2    Claim 16, wherein the frequency selective reflector and the output end reflector are

3    arranged to output laser light converted by the frequency converter to be used at a

4    workpiece at the converted frequency.

1    19. (Currently Amended) A laser cavity as ~~claimed in claim any of claims 16 to 18~~

2    defined in Claim 16, in which the frequency converter is a second harmonic generator.

1 20. (Currently Amended) A laser cavity as ~~claimed in any of claims 16 to 19 defined~~  
2 ~~in Claim 16,~~ in which the output end reflector reflects the fundamental frequency  
3 generated by the gain medium.

1 21. (Currently Amended) A laser cavity as ~~claimed in any of claims 16 to 20 defined~~  
2 ~~in Claim 16,~~ in which the frequency converter has a large acceptance angle.

1 22. (Currently Amended) A laser including a laser cavity as ~~claimed in any of claims~~  
2 ~~16 to 21.~~ defined in Claim 16.

1 23. (Currently Amended) A laser ablation device comprising a laser as ~~claimed in~~  
2 ~~claim 9, claim 13 or claim 22.~~ defined in Claim 9.

1 24. (Currently Amended) A method of profiling a laser gain medium end ~~comprising~~  
2 comprising:  
3 ~~to provide providing~~ a level of thermal lensing at a predetermined pump power  
4 such that a predetermined beam quality is achieved at the predetermined pump power.

1 25. (Currently Amended) A method of controlling pumping of a Q-switched pulsed  
2 laser ~~comprising comprising:~~  
3 reducing pump power to a quiescent level between bursts of laser pulses.

1    26. (Currently Amended) A laser amplifier having:  
2                a laser cavity; and  
3                an amplifying module external to the laser cavity, said amplifying module sharing  
4                a common axis of emission with said laser cavity and comprising a gain medium having  
5                first and second ends along said axis of ~~emission~~, emission;  
6                whereby at least one of said first or second ends is profiled so as to directly couple light  
7                from said laser cavity into said amplifying module.

1    27. (Currently Amended) A laser amplifier as ~~claimed in claim 26 defined in Claim~~  
2        26, wherein one or both of said first ~~or~~ an second ends are profiled to form a lens having  
3        a predetermined focal length.

1    28. (Currently Amended) A laser amplifier as ~~claimed in claim 26 defined in Claim~~  
2        26, wherein said laser comprises a gain medium with profiled ends.

1    29. (Currently Amended) A laser amplifier as ~~claimed in claims 27 or 28 defined in~~  
2        Claim 27, in which the lens is one of a refractive lens, a diffractive lens, or a GRIN lens.

1    30. (Currently Amended) A laser amplifier as ~~claimed in claims 27 or 28 defined in~~  
2        Claim 27, wherein said laser gain medium ends are profiled to form a lens having a  
3        predetermined focal length.

1 31. (Currently Amended) A laser amplifier as ~~claimed in any of claims 27 to 28~~  
2 defined in Claim 30, wherein said lens of said laser gain medium and said lens of  
3 amplifier gain medium have substantially equal focal lengths.

1 32. (Currently Amended) A laser amplifier as ~~claimed in any preceding claim defined~~  
2 in Claim 30, whereby said laser gain medium lens and said amplifier gain medium lens  
3 are concavely profiled.

1 33. (Currently Amended) A laser amplifier as ~~claimed in any preceding claim, defined~~  
2 in Claim 26, wherein said laser and said amplifying medium are pumped simultaneously.

1 34. (Currently Amended) A laser amplifier as ~~claimed in claim 33 defined in Claim~~  
2 33, wherein said laser pump and said amplifying pump have equal power.

1 35. (Currently Amended) A laser amplifier as ~~claimed in any preceding claim defined~~  
2 in Claim 26, in which an input surface to the amplifier is tilted.

1 36. (Currently Amended) An optical amplifier module comprising comprising:  
2 a medium having first and second ends, at least one end being profiled to provide a  
3 level of lensing at a predetermined operating power, arranged such that, in use, the  
4 amplifier can be directly coupled to a laser of predetermined parameters.

1 37. (Currently Amended) A module as ~~claimed in claim 33 defined in Claim 33~~, in  
2 which, for an amplifier medium comprising a rod of diameter  $D_R$ , length  $L_R$ ,  
3 refractive index  $n_L$   $n_L$ , in air of refractive index  $n_{air}$  of air  $n_{air}$ , and thermal focal length  
4  $f_{th}$  arranged to receive an input beam from a laser having waist distance  $d_0$  from the  
5 input rod end, the rod is profiled with a radius of curvature  $R$  given approximately by

6 
$$R = \frac{d_0(4f_{th} - L_R)(n_L - n_{air})}{n_L(4f_{th} - L_R - 2d_0)}.$$

1 38. (Currently Amended) A method of making a laser amplifier module gain medium  
2 comprising comprising:

3 profiling at least one end thereof to provide a level of lensing at a predetermined  
4 operating power, arranged such that that, in use, the amplifier can be directly coupled to a  
5 laser of predetermined parameters.

1 39. (Currently Amended) A method of designing a laser amplifier as ~~claimed in any~~  
2 ~~preceding claim~~ comprising identifying a profile as defined in ~~claims 11 or 12. Claim 34.~~

40. (Cancelled).

1 41. (Currently Amended) A method of controlling pumping in a Q-switched, pulsed  
2 laser comprising comprising:

3           reducing pump power below the laser cavity lasing threshold prior to full-power  
4        pumping.

1    42.    (Currently Amended) A method of converting laser frequency in a laser cavity  
2    comprising comprising:  
3       cooling a frequency converter in the laser cavity to below an optimum frequency  
4        conversion temperature while the laser is in a non-lasing state.

1    43.    (Currently Amended) A laser assembly comprising a gain medium ~~cavity, laser or~~  
2    switch as ~~claimed in any of claims 1 to 22 defined in Claim 1~~ and an amplifier ~~or module~~  
3    as ~~claimed in any of claims 26 to 37 defined in Claim 26~~ coupled therewith.